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PROCEEDINGS.

Six hundred and seventieth Meeting.

May 26, 1874. — ANNUAL MEETING.

The PRESIDENT in the chair.

The following gentlemen were elected members of the Academy: —

James Prescott Joule, of Manchester, to be a Foreign Honorary Member in Class II., Section 1, in place of the late Professor Quetelet, of Brussels.

William Hallows Miller, of Cambridge, to be a Foreign Honorary Member in Class II., Section 1, in place of the late C. F. Naumann, of Leipsic.

Johann Christian Poggendorff, of Berlin, to be a Foreign Honorary Member in Class I., Section 3, in place of the late A. de la Rive, of Geneva.

Francis Wharton, of Cambridge, to be a Resident Fellow in Class III., Section 2.

The annual election resulted in the choice of the following officers: —

CHARLES FRANCIS ADAMS, *President*.

JOSEPH LOVERING, *Vice-President*.

JOSIAH P. COOKE, JR., *Corresponding Secretary*.

EDWARD C. PICKERING, *Recording Secretary*.

EDMUND QUINCY, *Treasurer and Librarian*.

Council.

JOHN B. HENCK,
BENJAMIN PEIRCE, } of Class I.
WOLCOTT GIBBS,

CHARLES PICKERING,
ALEXANDER AGASSIZ, } of Class II.
ASA GRAY,

ROBERT C. WINTHROP, }
GEORGE E. ELLIS, } of Class III.
ANDREW P. PEABODY,

Rumford Committee.

MORRILL WYMAN.	JAMES B. FRANCIS.
WOLCOTT GIBBS.	JOHN M. ORDWAY.
JOSIAH P. COOKE, JR.	STEPHEN P. RUGGLES.
EDWARD C. PICKERING.	

Committee on Finance.

CHARLES FRANCIS ADAMS, } *ex officio*.
EDMUND QUINCY,
THOMAS T. BOUVÉ.

The following Committees were appointed on the nomination of the President: —

Committee on Publication.

ALEXANDER AGASSIZ.	W. W. GOODWIN.
JOHN TROWBRIDGE.	

Committee on Library.

CHARLES DEANE.	HENRY P. BOWDITCH.
WILLIAM R. NICHOLS.	

Auditing Committee.

HENRY G. DENNY.	ROBERT W. HOOPER.
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The report of the Rumford Committee was read and accepted. In accordance with its suggestion, it was voted that the sum of two thousand dollars (\$2,000) be appropriated from the Rumford Fund for the publication of Volume IV. of Rumford's Works. Also, voted that the cost of papers by Professors Cooke and Pickering in the Proceedings be charged to the Rumford Fund.

The report of the Treasurer was then read; and, in accordance with its suggestion, it was voted to appropriate, —

For General Expenses	\$2,100
For Publication	1,000
For Library	700

It was voted that this meeting adjourn, at its close, to the second Tuesday in June.

Professor Hunt presented a communication on Stellar Spectra.

It was voted that the Secretaries may, at their discretion, give, to authors of original papers printed in the Proceedings, fifty extra copies at the expense of the Academy.

Six hundred and seventy-first Meeting.

June 9, 1874. — ADJOURNED ANNUAL MEETING.

The PRESIDENT in the chair.

The Corresponding Secretary presented Volume IX. of the Proceedings to the Academy.

It was voted to amend the vote passed at the last meeting in regard to extra copies of papers published in the Proceedings, by changing the number from fifty to one hundred.

The President read a report from the Librarian, stating the number of copies of the various volumes of Memoirs and Proceedings of the Academy now on hand.

Professor E. C. Pickering presented a communication on the Pressure of Vapors.

Professor Josiah P. Cooke read a paper by Mr. F. A. Gooch on a new species of Vermiculite.

Professor Asa Gray presented by title a paper on a "Revision of the North American Thistles; and the Characters of certain New Species of Plants."

It was voted that the meeting in August be adjourned to the second Tuesday in October.

Six hundred and seventy-second Meeting.

October 13, 1874. — ADJOURNED STATED MEETING.

The PRESIDENT in the chair.

The Corresponding Secretary read letters from Professor W. H. Miller, of Cambridge, England, and J. P. Joule, of Manchester, acknowledging their election as Foreign Honorary Members of the Academy.

The President announced the death of Messrs. Fairbairn, Guizot, and Élie de Beaumont, Foreign Honorary Members, and of Messrs. George Derby, Jeffries Wyman, Francis C. Lowell, and Benjamin R. Curtis, Resident Fellows of the Academy.

Dr. George E. Ellis stated that the tomb of Rumford, near Paris, suffered severe injuries during the war; and, in accordance with his motion, it was voted to refer to the Rumford Committee the question whether it was advisable to appropriate any money from the Rumford Fund towards the cost of repairing the monument.

A paper was presented by title, "On the Hexatomic Compounds of Cobalt," by Professor Wolcott Gibbs.

Professor Asa Gray presented, by title, "Contributions to the Botany of the United States, chiefly of the Northern Regions;" a continuation of the paper read by title at the preceding meeting.

Professor E. C. Pickering presented a communication on Graphical Integration.

Six hundred and seventy-third Meeting.

November 11, 1874. — STATED MEETING.

The PRESIDENT in the chair.

The President announced the death of Dr. N. B. Shurtleff, Resident Fellow of the Academy.

Professor Josiah P. Cooke reported that the Rumford Committee recommended that the Academy appropriate one hundred and seventy-five dollars from its general fund (\$175), for repairing the tomb of Count Rumford.

Referred to the Committee on Finance.

The Committee reported favorably; and accordingly it was —

Voted, to appropriate one hundred and seventy-five dollars (\$175) for this purpose.

The following gentlemen were elected members of the Academy: —

Charles Hallett Wing, of Boston, to be a Resident Fellow in Class I., Section 3.

John McCrady, of Cambridge, to be a Resident Fellow in Class II., Section 3.

William Gilson Farlow, of Cambridge, to be a Resident Fellow in Class II., Section 2.

Sereno Watson, of Cambridge, to be a Resident Fellow in Class II., Section 2.

Julius E. Hilgard, of Washington, to be an Associate Fellow in Class I., Section 2.

William Petit Trowbridge, of New Haven, to be an Associate Fellow in Class I., Section 4.

William Alexander Hammond, of New York, to be an Associate Fellow in Class II., Section 4.

James Hammond Trumbull, of Hartford, to be an Associate Fellow in Class III., Section 3.

James McCosh, of Princeton, to be an Associate Fellow in Class III., Section 1.

Robert Virchow, of Berlin, to be a Foreign Honorary Member in Class II., Section 4, in place of the late Dr. P. C. H. Louis, of Paris.

James Clerk Maxwell, of Cambridge, to be a Foreign Honorary Member in Class I., Section 3, in place of the late P. A. Hansen, of Seeberg.

Professor T. H. Safford presented a communication on the "Motion of the Solar System in Space."

Mr. S. H. Scudder presented, by title, a "Historical Sketch of the Generic Names proposed for Butterflies."

Professor Josiah P. Cooke spoke of the large amount of lead and copper present in commercial tartaric acid and cream of tartar.

Six hundred and seventy-fourth Meeting.

December 8, 1874. — MONTHLY MEETING.

The PRESIDENT in the chair.

The Corresponding Secretary read letters from Messrs. Hammond, Hilgard, McCosh, Trowbridge, Trumbull, and McCrady, acknowledging their election into the Academy.

Mr. W. A. Rogers described the unequal effects he obtained in ruling a glass plate with a diamond point, when the lines were drawn in different directions; and these variations he attributed to the grain of the glass.

The President read a report of the Committee to whom was referred the paper of Professor Benjamin Peirce on Ocean Steamship Lanes:—

The Committee of the Academy, to whom was referred a paper submitted to the meeting of the Fellows held on the 12th of May last, by Professor B. Peirce, relating to the course of navigation over the Atlantic Ocean by steamships passing daily between America and Europe, have considered that subject, and ask leave to report:—

That this is a matter deserving the attention of the society from its growing importance to the safety of multitudes of human beings constantly passing and repassing between the two continents. If the development of this line of navigation for the future is to be measured by its progress during the thirty-five years since it commenced, then it unavoidably follows that without the adoption of some form of systematic precaution there will be a steadily growing danger of serious

accidents from collision, attended by fearful loss of life, not to speak of wide destruction of property.

When the Cunard Company took the lead in this course of enterprise, it sent forth four steamers, which made two passages each way in every month. At that time the hazard from collision was so slight as scarcely to merit consideration. But at this time, when nine steamers often depart in a single day of the week from each side, and more or less in number do so on five other days of the same week, it is obvious that the danger of unexpectedly meeting has become quite serious enough to call for attention, and the consideration of some practical means of guarding against it.

Yet, if it be assumed that so remarkable a development of this navigation has taken place within so short a period of time, the fact implies a probability of an indefinite expansion of it for the future. The relations between the two continents may be said to be even now but in their infancy. Even the modes of conducting them vary from year to year in harmony with the multiplication of the numbers of human beings who make the passage. Sharp competition stimulates the production of larger vessels and of increased power to move them. The aim is also to resort to new means of shortening the period of transit. All these motives combine to increase indefinitely the chances of accident by collision among vessels directed in the shortest course. Each commander is naturally ambitious to be distinguished for the celerity with which he passes from port to port. Each organized company naturally desires to be identified in the public mind with the notion of speed in their vessels quite as much as with that of safety. This in the long run will be sure to produce a rivalry that must inevitably draw all vessels more and more to the shortest line between the ports of destination. Hence must happen a degree of proximity more or less dangerous, especially in doubtful or thick weather and at night.

In making this statement, it is not intended to imply any want of the requisite vigilance to guard against present danger in those who now control this course of navigation. On the contrary, it is believed that all possible care is taken within the narrow compass of authority exercised by each organization. But it is not so much with the present that the danger lies as it is with the future. To secure more safety, greater precaution should be used in advance of the fearful lessons that experience draws from the neglect of it. It would seem that one measure at least might be adopted immediately. There should be some common agreement entered into by all the parties

interested in these modes of transportation to define as clearly as it can be done the precise line of navigation it is intended to pursue.

In connection with these considerations, Professor Benjamin Peirce, who had previously given much reflection to the subject, presented a paper at a meeting of the Fellows of this Academy in May last, the object of which was to suggest the expediency of some friendly action in the way of promoting a general co-operation toward the attainment of this desirable end. The most obvious one is that proposed by him of inviting the concurrence of the various associations in this navigation in establishing a course of what may be denominated OCEAN LANES; in other words, two distinct tracks of specified breadth over the Atlantic, in one of which the steamers bound eastward should direct their course, and those bound westward should as uniformly move in the other.

This idea cannot be said to be new. It was suggested twenty years ago by private individuals; and it has been in some sense adopted and carried out, so far as it was possible for a single company to do it. It is well known that the Cunard Company has laid down a clear course for the direction of its own ships. This rule prescribes for the outward passage to America one crossing the meridian of 50° at 43° north latitude, or nothing to the south of 43° ; and for the homeward track crossing the same meridian at 42° latitude, or nothing to the north of 42° . A plan like this is eligible on account of its simplicity; and for that reason, if there was no other, it would seem to recommend itself to general adoption by all other companies. Should each of these, on the other hand, select a distinct and separate course for itself, it is obvious that confusion would be likely to spring up, especially among masters of sailing vessels, who would be best guarded from interposition by the plain and single idea that within certain specified lines of latitude the swift steamers which they most dread are to be met with, and to that end extraordinary watchfulness should there be required.

But, if this track be adopted at all, it would seem to be desirable not only that it be adopted by all steamers crossing the Atlantic in the contrary directions, but that it be steadily adhered to through all seasons of the year. The deviation from the shortest line is scarcely sufficient to make a variation a temptation to save time, especially in view of the advantage of escaping the notorious hazards clustering about the banks of Newfoundland. The anxiety of the best navigators in making that passage at certain seasons of the year, is so strongly felt by them that they would be among the first to rejoice to be relieved from it.

Under these circumstances, the single duty incumbent upon the Academy in this case would appear to be to present the subject to the earnest consideration of all parties interested in the maintenance of these great and growing channels of transportation of human beings, and to urge them by all means to co-operate in some plan of this kind to avoid, so far as they can, the manifestly growing dangers from the extension of their enterprises. If it should be found that, by any other plan than the one proposed, still greater security would be likely to be afforded, such a result would be hailed by us with still higher satisfaction. The great object of saving life and suffering is highly worth any amount of labor and cost expended in attaining it. It does not appear to be within the province of effective legislation. A proper direction given to public opinion all over the commercial world is believed to be far more likely to be efficacious with persons who must largely depend upon public opinion for their prosperity. Neither is there any reason from their past action to infer them to be unwilling to do every thing that may reasonably be demanded to insure the general safety.

CHARLES FRANCIS ADAMS,	} <i>Committee.</i>
GEORGE T. BIGELOW,	
JOHN H. CLIFFORD,	
H. H. HUNNEWELL,	
J. INGERSOLL BOWDITCH,	

It was voted to accept this report, and authorize the Secretary to send copies of it to such of the daily papers and steamship companies as he deemed fit.

The President read a letter from the President of the Geographical Society of Paris, inviting co-operation on the part of the Academy.

Mr. Washburn presented a report of the committee appointed to consider the question of Expert Evidence. It was voted to request this committee to continue their labors.

Six hundred and seventy-fifth Meeting.

January 12, 1875. — MONTHLY MEETING.

The PRESIDENT in the chair.

Professor Wolcott Gibbs announced the discovery of an extensive series of well-defined salts, in which molybdc and tungstic teroxides play the part of bases.

The Corresponding Secretary presented a paper, by Dr. A. A. Hayes, "On the Wide Diffusion of Vanadium, and its Association with Phosphorus in many Rocks."

The President announced the death of the Rev. James Walker, D.D., Resident Fellow of the Academy.

Six hundred and seventy-sixth Meeting.

January 27, 1875. — STATED MEETING.

The PRESIDENT in the chair.

The following gentlemen were elected into the Academy:—

Henry Barker Hill, of Cambridge, to be a Resident Fellow in Class I., Section 3.

James Bradstreet Greenough, of Cambridge, to be a Resident Fellow in Class III., Section 2.

William James, of Cambridge, to be a Resident Fellow in Class II., Section 3.

Joachim Barrande, of Prague, to be a Foreign Honorary Member in Class II., Section 1, in place of the late Élie de Beaumont.

Louis Adolphe Thiers, of Paris, to be a Foreign Honorary Member in Class III., Section 3, in place of the late F. P. G. Guizot, of Paris.

Jean Léon Gérôme, of Paris, to be a Foreign Honorary Member in Class III., Section 4, in place of the late W. von Kaulbach, of Munich.

Professor E. C. Pickering communicated the results of some experiments on the "Foci of Lenses Placed Obliquely," by himself and Dr. Charles H. Williams.

The President read a letter from the President of the Geographical Society of Paris, inviting the Academy to send a delegate to the International Congress of Geographical Sciences, to be held at Paris during the coming summer.

Six hundred and seventy-seventh Meeting.

February 9, 1875. — MONTHLY MEETING.

The PRESIDENT in the chair.

The President announced the death of Dr. Charles G. Putnam, Resident Fellow.

It was voted to refer to the Council the letter read at the last meeting from the President of the Geographical Society.

Professor N. S. Shaler presented a communication on the Freezing of Water in Bomb-shells.

Six hundred and seventy-eighth Meeting.

March 9, 1875. — MONTHLY MEETING.

The PRESIDENT in the chair.

The Corresponding Secretary read a letter from the Royal Institution of Civil Engineers of Ireland, inviting an exchange of publications; also, a letter from the Royal Academy of Brussels, inviting subscriptions to a monument in honor of Quetelet; also, letters from Messrs. Hill, James, and Greenough, acknowledging their election as Fellows of the Academy; also, letters from James Clerk Maxwell, of Cambridge, England, and Jean Léon Gérôme, of Paris, acknowledging their election as Foreign Honorary Members.

The President announced the death of Sir Charles Lyell, Foreign Honorary Member.

The President announced that the letter from the Geographical Society of Paris had been considered by the Council; and, in accordance with their recommendation, it was voted to accept the invitation of the Society, and Hon. R. C. Winthrop was appointed to represent the Academy at the ensuing Congress.

Mr. C. S. Peirce presented a paper on "Photometric Measurements of the Stars."

Professor John Trowbridge presented, by title, a paper on the "Effect of Heat upon the Magnetic Susceptibility of Soft Iron," by H. Amory and F. Minot.

Professor W. Watson presented a copy of his work on "Descriptive Geometry" to the Academy.

Prof. Asa Gray presented, by title, a paper, "A Conspectus of the North American Hydrophyllaceæ."

Mr. Sereno Watson presented, by title, a paper on the "Revision of the Genus *Ceanothus*, and Descriptions of New Plants, with a Synopsis of the Western Species of *Silene*."

Dr. W. G. Farlow presented, by title, a paper on the Algæ of the United States.

Six hundred and seventy-ninth Meeting.

April 13, 1875. — MONTHLY MEETING.

The PRESIDENT in the chair.

Professor Wolcott Gibbs communicated the following "Optical Notices:" —

1. On a New Optical Constant.
2. On the Determination of Indices of Refraction without the use of Divided Instruments.
3. On a New Optical Instrument.

Professor John Trowbridge read a paper, "On a New Form of Induction Coil."

Professor Trowbridge also communicated two papers from the Physical Laboratory of Harvard College, by undergraduates of the University: —

1. On the Effects of Armatures upon Electro-Magnets, by B. O. Peirce and E. B. Lefavour.
2. On the Time of Demagnetization of Soft Iron, by W. C. Hodgkins and J. H. Jennings.

The Recording Secretary presented, by title, a paper, "On the Light transmitted through one or more Plates of Glass," by W. W. Jacques.

Six hundred and eightieth Meeting.

May 11, 1875. — MONTHLY MEETING.

The PRESIDENT in the chair.

The Corresponding Secretary presented, in print, the Report of the Council for the past year, which is hereto appended. He also read a letter from M. Thiers, acknowledging his election as Foreign Honorary Member of the Academy. The following scientific communications were then made, but the first two were only read by title: —

On the Application of Logical Analysis to Multiple Algebra, by C. S. Peirce.

On the Uses and Transformations of Linear Algebra, by Benjamin Peirce.

On the Intensity of Twilight, by Charles H. Williams.

On the Light of the Sky, by W. O. Crosby.

On Light Absorbed by the Atmosphere of the Sun, by E. C. Pickering and D. P. Strange.

On Tests of Magneto-Electric Machines, by E. C. Pickering and D. P. Strange.

Answer to M. Jamin's Objections to Ampère's Theory, by William W. Jacques.

On Melanosiderite: a New Mineral Species, from Mineral Hill, Delaware County, Pennsylvania, by Josiah P. Cooke, Jr.

On Two New Vermiculites, with a Revision of the other Members of this Group of Minerals, by Josiah P. Cooke, Jr., and F. A. Gooch.

On a Possible Explanation of the Method employed by Nobert in Ruling his Test Plates, by William A. Rogers.

On the Solar Motion and Stellar Distances, second paper, by T. H. Safford.